WASHINGTON
SCIENCE TRENDS

HIGHLIGHTS

* R&D Trends
* Military Technology
* Science in Space
* Publications Checklist

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R&D TRENDS

* Beryllium Field Test: U.S. Bureau of Mines hopes to spur a nationwide hunt for beryllium sources to meet growing demand. Bureau researchers have now developed an easy-to-perform, five-minute field test which is said to employ inexpensive and readily available chemicals and equipment. The testing procedure is reported to detect amounts of beryllium as small as thirteen-thousandths of one percent.

  (Complete details now available. Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for U.S. Bureau of Mines Information Circular 7946. Price, 15 cents)

* Flight Recorders: Increasing emphasis on these devices comes from the Federal Aviation Agency. Latest proposal would require all turbine powered air carrier aircraft -- including turboprops -- be equipped with an instrument which automatically records on steel or aluminum tape the plane's airspeed, altitude, vertical acceleration, heading and time.

  (Federal Aviation Agency, Dockets Section, Washington 25, D.C. will accept comments on the proposed rules until May 3, 1960)

* Mauler Missile System: Convair-Pomona Division of General Dynamics receives a $5.5 million first-year development contract for this highly mobile battlefield air defense system. Solid-fueled radar-guided missiles are to be employed, primarily to destroy short-range enemy ballistic missiles and rockets, and high performance tactical aircraft. Each Mauler unit will be carried in a single tracked vehicle of standard design, with its own power supply, target detection and electronic computer fire control equipment. Missiles will be pre-packed in lightweight cases to serve both as shipping containers and launching tubes.

* Environmental Test Facilities: The Director of the Pentagon's Weapons Systems Evaluation Group predicts that more new environmental test facilities will be required as the military services move into space operations. Vice Admiral John H. Sides warns that forthcoming vehicles will be so costly and complex it would be folly to attempt to achieve reliability through large-scale test firing programs -- that facilities must be built and reserved exclusively for long-term environmental testing.

Military Technology

Here is a summary of some current developments in the Army, Navy and Air Force technical-procurement program. (For a summary of other major procurement by the military services see Federal Budget Digest, Washington Science Trends, Jan. 18, 1959)

* Redeye: Army and Marines expect the Redeye self-contained, lightweight shoulder-fired, guided missile to eventually replace the machine gun for defense against low-flying enemy aircraft. The weapon consists of (1) the missile in a sealed shipping tube which becomes the launcher when the end caps are removed; (2) a grip stock which becomes the trigger mechanism; and (3) a battery for missile warmup and firing. Weapon weighs 18.2 pounds and is designed for issue through normal ammunition supply channels. It is said to require neither supporting equipment nor pre-firing checkout. As previously announced, the missile uses the heat seeking, infrared guidance principle.

* Telephone Carrier Terminal: The Army plans to buy 1,240 sets during Fiscal 1961 of this equipment, which provides 12 voice channels over a single radio circuit or a pair of wires. Stacked together, 2 of these terminals can provide 24 voice channels over a single radio circuit. The terminals are said to be about one-half the size and lighter in weight than currently available equipment and will be installed and operated by Army Combat Area Signal Battalions and Division Signal Battalions.

* Short Range Surveillance Drone: The Army expects to purchase 6 USD Short Range Surveillance Drone systems at a cost of $6.6 million during Fiscal 1961. Each system consists of 10 drones, 2 launchers and various photographic, infrared and side-looking radar sensors. The drone has a normal operating radius of 50 miles, carries a payload of 200 pounds and is expected to remain aloft for 45 minutes at speeds of 350 miles per hour.

* Integrated Doppler Navigator: Surveillance aircraft will use this equipment which is said to be completely independent of ground navigational facilities, and free from detection and countermeasures to the maximum extent possible. The radar doppler navigator will provide point-to-point air navigation and information such as ground track, heading, course, distance to destination and present position. The narrowness of the radiated beams is said to be a major advantage for combat surveillance. This will be the Army's first purchase of this equipment -- 54 navigators at a total cost of $8.1 million.

* Infrared Weapons Sight: The Army expects to purchase 1,000 of these new sights during the coming year at a total cost of $½ million. The sight is said to have twice the range and about one half the weight of the currently-used Sniperscope, which it replaces. The sight consists of an infrared projector, and viewing device and a knapsack-type battery operated powerpack. It is said to permit accurate small arms fire at night without the use of visible light.

* Deep-Diving Submarine: The Navy expects to spend $20.8 million for its first deep-diving submarine, designed to provide a small vehicle for experimental development of hull structures, sonar equipments and anti-submarine weapon systems. The submarine will be powered by a single-screw, diesel electric battery system and will have a single 21-inch torpedo tube. When not engaged in obtaining information required for future submarine designs, it will serve as a medium-speed deep weapon impact target for anti-submarine warfare forces.

* LaCrosse: The Army and the Marine Corps appear to be in sharp dispute over the merits of the LaCrosse, a missile designed for use against enemy pillboxes and similar installations. Army witnesses have told Congress that "if we get the missile into the air right, it is extremely accurate." They attributed improved reliability in recent months to better engineering and "more and more pressure on the Martin Co. to increase its systems reliability performance." The Martin Co. has received $167,336,765.04 from inception of the program. Marine witnesses described reliability as "extremely low at the present time, both in preflight checkout and in flight checkout" and declared that "any radio transmitter" operating on the same frequency could interfere with control.

* Polaris Submarine Problem: Mare Island Shipyards are said to have experienced a delay in a submarine designed for the Polaris missile system due to difficulties experienced in the processing and fabrication of HY-80 steel used for the main pressure hulls.

* Hydrofoil Craft: The Navy expects to award a contract shortly for its first hydrofiol ship, a 115-ton, 110 foot craft with two varieties of sonar equipment. One will be a hull-mounted sonar with two transducers and one will be a new type of variable depth sonar that can be lowered and raised into the center section of the ship. Estimated cost is $6.7 million.

* ASW Electronics: The Navy expects to have two important new items for anti-submarine warfare during the coming year. Procurement is planned for a device which will greatly increase the accuracy of sonar detection and localization at long ranges and a modification to existing sonars which will increase detection ranges approximately 30 percent.

* Fleet Air Defense Equipment: Here is a Navy status report --

#Large, Long-range Radar: Evaluation in Spring, 1960. Production contract planned for Fiscal Year 1961. Designation AN/SPS -13.
#Radar Indicator: Operational evaluation began January, 1960. Service approval expected by September, 1960. Production contract planned for Fiscal Year 1961. Designation AN/SPA -40.
#Height-Finding Radar: Currently under evaluation. Production contract planned for Fiscal Year 1960 with funds previously appropriated. Designation AN/SPS 30.
#Intercept Tracking: Service approval expected by November, 1960. Production Contract planned for Fiscal Year 1961. Designation AN/SPS -43.

* Sonobuoy Reliability: Navy believes that highly competitive bidding may be contributing to reliability problems in current sonobuoy procurement. The Navy is tightening up reliability specifications and intends to cut down the number of contractors in this field (currently six) and to award next year's procurement to contractors with the best reliability record.

* Minuteman Sea Launch: Air Force and Navy have discussed the possibility of establishing a Minuteman ICBM launching platform at sea off the U.S. coast. Indications are that this could be done from a ship, contributing additional mobility to the system.

* J-79 Engine: Cracking of the first stage compressor blades has become a problem with the J-79 jet engine installed in the Air Force B-58 and F-104 aircraft. The problem appears to be one of design; The means by which the blades have been fastened.

SCIENCE IN SPACE

Background: Space Science Board, National Academy of Sciences, is completing its review of areas and opportunities for important research studies using space vehicles. Here are some of the major proposals for:

Lunar Research

* Lunar Satellite: Counting systems would be devised for detection of potassium, uranium and thorium. Satellite, some 100 kilometers above the surface would be able to determine relative abundances of these elements and whether surface is granitic, basaltic, or meteoric and whether compositions of the maria and land areas are different. Television should be used if high resolution can be secured. Orbital constants of lunar satellite can be used to determine mass distribution, bearing on the question of melting and answering the question of whether there are irregular distributions of high-density materials. Density and composition of lunar atmosphere could be secured by use of suitable mass spectrometers. Determination of reflectivity of surface as a function of wavelength should be made. Exploration of the lunar magnetic field with high sensitivity magnetometers and tests for trapped low energy particles should be made.

* Hard Landing Lunar Probe could include a wide-open ion chamber to determine atmospheric density by radioing results as vehicle approached the Moon. It should be possible to test the hardness of the surface by a probe at the end of the vehicle.

* Soft Landing Lunar Probe could televise the surface with and without magnification and with the aid of a microscope. This should indicate whether the material was produced by solidification of a melt or by consolidation. Minerals could be detected, indicating whether it was granitic or basaltic in composition. Surface should be tested for magnetic substances on surface and some meters down to determine, at a number of locations, how extensive arrival of meteoritic material has been. Hardness tests and probes of considerable depth should be used to determine whether the maria and interiors of craters are conglomerates or solidified lava. Seismic observations to detect internal irregularities of density and composition may determine whether dissipation of tidal energy is occuring, and whether heating in the interior is causing seismic activity.

Counters for detection of uranium, potassium and thorium could be used as in the lunar satellite. Detailed chemical analysis could be possible with a spark-type mass spectrometer. Temperature as a function of depth, latitude, time of lunar day and depth of lunar surface should be measured. X-ray fluorescence spectra could be secured by intense radioactive sources now available. X-ray diffraction analysis should be considered. Spectroscopic analysis of surface rocks should be possible. Surface materials might be heated to detect volatiles. Lunar gravity might be measured, although interpretation would be difficult. A gravimeter will measure the lunar monthly tides and determine the rigidity of the Moon and its physical state in the deep interior.

* Return of Samples, both surface and core, should be from many locations. Apparatus for collection and return should be developed. Areas of particular sampling interest are indicated. Samples of lunar dust should be collected under sterile conditions for the use of biologists in making cultures. Terrestrial tests required for lunar samples include ordinary chemical analysis, x-ray fluorescence analysis, analysis for content of ordinary gases and for the inert gases which may be produced by cosmic rays, potassium-argon dating and dating by other methods, microscopic examination, mineral analysis.

* Manned Landing: The first man to go to the Moon should have a considerable knowledge of several fields of science but he should be particularly "a hard-rock geologist" with some acquaintance with meteroities.

Planetary Investigations

* Television observations should be made in light of varying wavelengths. Observations from outside a planet could have a resolving power in the neighborhood of 10 kilometers. If soft landings can be made television of the landscape and through magnifying apparatus would be important in order to detect life, minerals, erosional and tectonic processes and topography. Temperatures might be determined from outside the atmosphere by using infrared radiation. In the case of soft landings it may be possible to determine temperature, pressure and depth of atmosphere by suitable apparatus as a balloon descends. Ionic effects in the atmosphere are of very great interest. Chemical composition might be secured from spectra, mass spectrometers or even simple chemical analytical apparatus.

* Planetary Satellites could provide information on mass and shape of Venus and lightning flashes, if any, in atmosphere of Mars and Venus. Radiation of Jupiter may also be studied.

* Biological tests which might be made with planetary probes include measurement of physical and chemical characteristics of environment; detection of spectra charactristics of known organic matter such as chlorophyll; detection by pulsed radar inspection of returns similar to terrestrial vegetation; photography and, in the case of soft landings, listening for noises, and return of samples.

Biologically significant information may need considerable simplification before transmission. Information theory may be helpful and simple, low power, slow computers may be required. In some kinds of photography it would be advantageous to reduce the redundancy of successive pictures before transmission. Balloon flights should be encouraged and financed because nearly all that can be learned from the observation of light can be observed as well from the Earth as from near the planets, providing the effects of the Earth's atmosphere can be sharply reduced.

(Full texts of Reports on "The Moon" (10 pages) and "The Planets" (13 pages) available at $1 each. Order from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, 25, D.C. Other sections of this Space Science Board report will be available in the coming weeks.)

Publication Checklist

( ) Visual Searching Techniques, The Proceedings of a 1959 Symposium containing the texts of 33 formal papers dealing with new developments in visual search techniques as they apply to military problems, operations analysis, and related fields. 266 pages. $3. (Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D.C., for Pub. 712)

( ) Titanium Sources, a Bureau of Mines investigation of ilmenite-bearing mineral deposits in two Oklahoma counties including a study of the potentials of this source for titanium pigments and as a raw material for titanium metal. Single copies free. (Write Publications-Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa., for Report of Investigation No. 5577)

( ) Sector-Focused Cyclotrons, the Proceedings of a 1959 Symposium on problems associated with design and construction of a new type fixed-frequency-cyclotron. The device is said to provide axial focusing for large ion currents, and also to permit the acceleration of particles to relativistic energies. A discussion of ion orbit theories and magnetic field calculations is included. 291 pages. $2.50. (Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington 25, D.C., for Publication 656)

( ) Scientific Instruments Industry, a brief report on general statistics for this industry during 1958 including employment, expenditures and related information. 3 pages. 10 cents. (Industry and Product Report, Scientific Instruments Industry Pub. MC(P) -38-A -6 available from Publications Office, U.S. Bureau of Census, Washington 25, D.C., or Field Offices, U.S. Department of Commerce)

( ) Microwave Components, a Government study which shows that such specialized components have become a greater than $90 million annual business. Includes information on shipments, employment, inventories and related information gathered during a mid-1959 Survey. 10 cents. (Write Superintendent of Documents, Government Printing Office, Washington, 25, D.C., or Field Offices, U.S. Department of Commerce for "Microwave Components:Production and Related Data.")

( ) Aerosols, a new U.S. Army translation of a 1955 compilation and review of Russian literature, including many photos and diagrams. The work relates aerosol activity to such fields as meteorology, botany, soil conservation, bacteriology, nuclear physics, insecticide production and industrial waste control as well as a number of other technical fields. 460 pages. $7.50. (Write OTS, U.S. Department of Commerce, Washington 25, D.C., for The Mechanics of Aerosols)

( ) Organic Fluorine Compounds, a literature survey containing 119 items concerning electrochemical fluorination of organic compounds from 1950 through July, 1959. Prepared at Oak Ridge, Tennessee, for the Atomic Energy Commission. 20 pages. 75 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Publication K-1438)